Sandia National Laboratories

Performance, Risk, and Decision Analysis

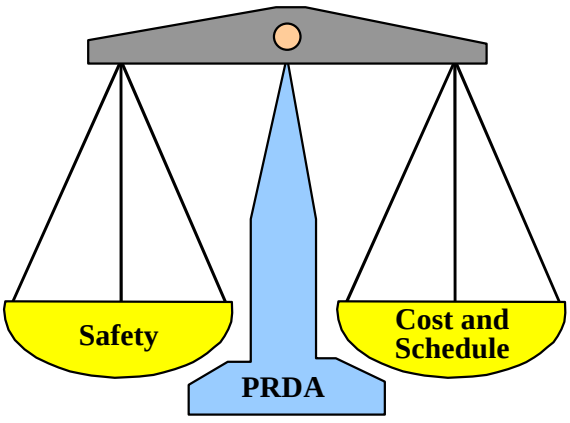
(Site Owners)

Missed Opportunities in Environmental Remediation Today

For remediation of a particular hazardous site today, decision analysis is applied at the macro-level with intuition and subjective estimates playing a major role. Typically, uncertainties are compensated for by introducing "worst case" assumptions in these assessments. In complex situations, defensible "worst case" assumptions are impossible to identify. Thus, owners are forced to apply standard approaches that do not fit that particular site's "true" characteristics. Regulators and stakeholders, however, are becoming aware that this approach often results in overly conservative assessments, and very high remediation costs with little actual risk reduction benefit.

The Solution: Sandia's Performance, Risk, and Decision Analysis

Over the last 20 years, Sandia has leveraged a $ 35 million investment to develop a unique, internationally recognized methodology for assessing the long-term behavior of contaminant mixtures in complex geologic environments. While this methodology was originally developed for the disposal of nuclear waste, continuous improvements have made it applicable to a variety of more common environmental problems such as bay and estuary remediation, brownfields, and superfund site remediation. The core of this capability is a probabilistic approach for the assessment of health risks that incorporates uncertainty and appropriate laws of science. Sandia has advanced the capability to differentiate among alternatives (no action, various data collection or remediation activities) which have complex interdependencies.



What is "Performane, Risk, and Decision Analysis" (PRDA)?

A systems-based approach designed to:

- Establish Site-Specific Remediation Goals
- Prioritize Data Needs
- Evaluate Health Risks and Costs Associated with Remediation Alternatives
- Quantify and Propagate Uncertainty
- Incorporate Public Concerns
- Evaluate Trade-offs among Remediation Alternatives, Data Gathering, Goals, and

Benefits

Sandia's PRDA combines the accuracy of scientific knowledge and modeling with a decision-oriented evaluation procedure to enable better environmental clean-up decisions. This approach goes beyond traditional risk and decision analysis methods by evaluating alternatives, using a technically sound and consistent PRDA methodology. You, as a site owner, will get a more defensible clean-up, while lowering remediation costs. In other words, this service pays for itself.

You will reap the following specific benefits:

1. More defensible site clean-up because:
    a. Contaminant transport over time and space is predicted.
    b. Solutions are based on Sandia's knowledge from previous modeling and analyses.
    c. Consistent clean-up approach is used across sites.
    d. Worst locations are identified and cleaned up first.
    e. Public buy-in is obtained up-front.
2. More cost and time effective site clean-up because:
    a. Only necessary data are gathered; only necessary areas are remediated.
    b. The probability of secondary and tertiary clean-ups is significantly reduced.
    c. Litigation, if it occurs, is less lengthy.

The Process

The process of evaluating sites for potential environmental remediation generally involves six major activities:

- ***Project Planning*** - Defines site remediation goals, develops conceptual models, and establishes site characterization plans.
- ***Public Involvement*** - Solicits public attitudes about planned project(s).
- ***Site Characterization*** - Provides necessary data in order to construct and refine site conceptual models, refine site characterization plans, and conduct risk assessments.
- ***Screen Remediation Alternatives*** - Provides the quantitative analysis needed to determine the need for remedial action and to compare health risks, incorporating cost and schedule considerations among remedial alternatives; also demonstrates compliance with regulatory requirements and establishes site-specific remediation goals.
- ***Remediation Technology Selection*** - Involves the identification of the technology that will best meet site remediation goals while satisfying stakeholder preferences.
- ***Assessments During Remediation*** - Provides interim guidance for potential mid-course corrections during remediation.

Why Use Sandia?

Sandia has extensive experience in contentious, political processes requiring the use of mathematical models and developing remediation alternatives. For example:

- ***WIPP: Waste Isolation Pilot Plant Performance Assessment*** - Defense transuranic waste disposal program.
- ***Yucca Mountain Performance Assessment*** - Commercial nuclear waste disposal program.
- ***Subseabed Disposal Project*** - International program investigating deep-sea disposal of high level nuclear waste.

The Sandia process includes public buy-in up-front. Also, a phased approach with "go/no-go" decision points enables optimal application of the PRDA methodology.

Who Will Get the Greatest Benefits from PRDA?

Owners of sites with expected remediation costs in excess of $1.5 million with **any** of the following characteristics:

a. **Multiple locations with diverse geologic, contaminant and regulatory characteristics.**
b. **Unclear and/or developing regulatory environment.**
c. **On-going monitoring requirements.**
d. **Probability of litigation.**

For more information please contact:

Dr. D.R. (Rip) Anderson
Sandia National Laboratories
P.O. Box 5800, MS 0779
Albuquerque, New Mexico 87185-0779
Phone: (505) 284-4600
Fax (505) 844-2348
e-mail: drander@sandia.gov

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